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Report on the Eleventh United Nations International Training Course on Remote Sensing Education for Educators

(Stockholm and Kiruna, Sweden, 2 May-9 June 2001)

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I. Introduction

A. Background and objective

1. The Eleventh United Nations International Training Course on Remote Sensing Education for Educators, held in Stockholm and Kiruna, Sweden, from 2 May to 9 June 2001, was organized by the United Nations Programme on Space Applications of the Office for Outer Space Affairs of the United Nations Secretariat in cooperation with the Government of Sweden as part of the 2001 activities of the Office for Outer Space Affairs. As was the case for the 10 previous courses in the series, the course in 2001 was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Cooperation Agency (Sida) on behalf of the Government of Sweden and was hosted by the Department of Physical Geography and Quaternary Geology of the University of Stockholm in Stockholm and by Metria Satellus AB (formerly SSC Satellitbild), in Kiruna.

2. The present report describes the organization of the training course, its technical contents, the results of the course evaluation and proposed follow-up action. It has been prepared for consideration by the Committee on the Peaceful Uses of Outer Space at its forty-fifth session and by its Scientific and Technical Subcommittee at its thirty-ninth session, in 2002. Participants have reported on the knowledge acquired and on the work conducted during the course to the appropriate authorities of the Government, universities and research institutions in their respective countries.

B. Organization and programme

3. Application forms for and information brochures on the training course were sent out in November 2000 by the Office for Outer Space Affairs to the permanent missions to the United Nations of 51 developing countries. Copies were also sent to the local offices of the United Nations Development Programme in those countries for transmission to the relevant national authorities. The same materials were distributed simultaneously to relevant Swedish embassies and to previous course participants for circulation in their academic institutions. One hundred and six completed applications from 34 developing countries were subsequently received and processed jointly by the Office for Outer Space Affairs and the University of Stockholm.

4. Twenty-six candidates, including 8 women, were selected as participants from the following 22 countries: Angola, Bangladesh, Chile, Costa Rica, Ethiopia, Ghana, Guyana, Haiti, Kenya, Malawi, Mozambique, Nepal, Nicaragua, Pakistan, Senegal, Sri Lanka, Swaziland, Thailand, Trinidad and Tobago, United Republic of Tanzania, Viet Nam and Venezuela. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. Support for the international travel of the remaining 13 participants, as well as the cost of room and board, course materials and inland transport for all 26 participants, was provided by the Government of Sweden. The European Space Agency (ESA) funded the participation of one course instructor.

5. Course instructors and speakers came from several institutions, including the Office for Outer Space Affairs, ESA, Sida, the University of Stockholm, the Swedish Royal College of Technology, the University of Uppsala, the Swedish National Space Board, L & L Monitor AB and Metria Satellus AB.

II. Summary of the contents of the course

6. Except for minor modifications to reflect technological advances and feedback received during annual course evaluations, the core content and structure of the course have not changed significantly over the years. The course is modular in format and consists of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in the report on the fifth course in the series (A/AC.105/617).

7. The first technical module of the course lasted four days and dealt with the fundamental principles of remote sensing. The principal topics covered were electromagnetic radiation, the reflective properties of various types of material on the surface of the Earth and elementary optics; electronic imaging;

georeferencing of objects in the field, on maps and on satellite imagery; Earth resources and environmental satellites; and remote sensing for land use planning and environmental monitoring.

8. Four days were subsequently devoted to image interpretation and presentations on the introduction to visual interpretation and in-service training in developing countries and on applications of remote sensing.

9. To reinforce understanding of the principles of image interpretation, participants were divided into groups on a regional basis; each group studied a case where visual interpretation of satellite images played a key role.

10. The next series of lectures dealt with digital image processing and analysis and geographic information systems (GIS). That part of the programme lasted six days and covered the following subjects: digital analysis (theory); computer image enhancement (theory); GIS theory; and digital image processing techniques, including computer-aided analysis, GIS applications, CD-ROM data capture, compass techniques and global positioning systems (GPS).

11. The participants were also introduced, over a period of five days, to the principles of radar image formation and the use of such images in various development and research applications. There were additional lectures on and practical training in GIS. In addition, the participants were introduced to the use of appropriate procedures for the field verification of interpretation of remotely sensed data using Landsat TM images of the Skinnskatteberg area in southern Sweden.

12. The next part of the course was held in Kiruna, at the facilities of Metria Satellus AB. Seven days were reserved for visual interpretation in project planning exercises and presentation of results, as well as for digital classification of satellite images and comparison of the results of visual and digital interpretation. Wherever possible, exercises were carried out on images selected by the participants of areas of their countries with which they were familiar. Lectures were also presented on the following subjects: archiving, catalogue updating and standard production of images; image processing, value-added production, radiometric and geometric corrections, digital elevation model (DEM) production; standard and higher-level processed imagery; and future Earth resource satellites.

13. While in Kiruna, technical visits were arranged for the participants to a number of sites of interest, including the ESA Salmijärvi and Esrange satellite receiving stations. Lectures were supplemented by a tour of the production facilities of Metria Satellus AB.

14. The final part of the course concerned the development of remote sensing curricula and was held over a period of three days in Stockholm at the Department of Physical Geography and Quaternary Geology. The participants worked in small groups set up on a regional basis and on the last day of this part of the course each group presented a sample remote sensing curriculum project, which, in addition to educational content, included such components as necessary teaching staff and equipment and required budget. The participants also received and took back home sets of teaching materials, which included books, teachers' notes, slides and images, as well as a compact disc with satellite data and GIS and image-processing software.

III. Course evaluation

15. On the last day of the course, during a half-day evaluation session, participants made a formal presentation of the course evaluation to representatives of the Office for Outer Space Affairs, the Department of Geography and Quaternary Geology and several course lecturers. Discussions following the formal presentation by the representative of the participants allowed additional inputs to be made by all participants.

16. During the formal presentation and discussions, participants emphasized that the training programme was well organized and that the course had achieved its major goal. They also made some suggestions, which they believed would improve the programme of the course in the future. The main suggestions and recommendations made were as follows: (a) advanced training in remote sensing and GIS should be organized for selected participants as a follow-up to the programme; (b) a special newsletter should be prepared and distributed to former participants in order to share ideas, to facilitate the exchange of experience and knowledge and to discuss educational opportunities;

(c) more stimulating teaching methods should be used at the course, including more interaction between instructors and participants, as well as more time allocated for practical exercises; and (d) teaching notes and other course-related materials should be distributed among participants in advance.

17. In order to evaluate the general organization of the training programme, a questionnaire prepared by Sida was distributed to participants during the final part of the course. A summary of the opinions of the participants derived from the 22 completed questionnaires is as follows: (a) 64 per cent thought the course was right in length; (b) 41 per cent found the schedule too heavy, while 59 per cent thought the daily schedule was right; (c) 55 per cent found that the theoretical training corresponded to their professional needs to a large or very large extent and 41 per cent said the same about the practical training; (d) 86 per cent found the overall level of the programme to be adequate from their personal professional point of view; (e) 55 per cent found that there were subjects not adequately covered in the programme, with most of them indicating geo-referencing, microwave remote sensing, digital techniques and GIS as requiring more attention; (f) 64 per cent found the methods of instruction to be very good; and (g) 50 per cent found the content of the programme relevant to their professional environment to a great or very great extent and 45 per cent thought that they would have an opportunity to apply the newly acquired knowledge and experience in their present employment to a great or very great extent.

18. The feedback received from the questionnaire will be taken into account in the development of the course programme for 2002, as, for example, recommendations made by participants in 2000 led to the extension of teaching in the practical use of GIS, as well as in digital image processing, in 2001.

19. At the conclusion of the discussions, the participants expressed their appreciation to the Government of Sweden, Sida, the University of Stockholm and the United Nations for making possible their participation in the training programme.

IV. Evaluation of the impact of the series of training courses on curriculum development

20. In 2001, the Office for Outer Space Affairs, in cooperation with the University of Stockholm, carried out a survey whose primary objective was to evaluate the impact that the series of United Nations/Sweden training courses had had on curriculum development and educational and research programmes at the local level, as well as to review the experience of past participants in the training course in introducing remote sensing into educational curricula and subsequently to determine the course's future direction, format and content. It was anticipated that the information received both from former participants and the academic administrations of their institutions would assist in determining the type of further training or other support needed by former participants and their respective universities and institutions.

21. The survey was conducted by means of two questionnaires developed by the Office for Outer Space Affairs in consultation with the University of Stockholm. The first questionnaire targeted former participants who had attended training courses between 1990 and 2000 and the second questionnaire was sent to the heads of departments, universities and institutions whose staff had participated in the courses.

22. The questionnaires addressed primarily the results of utilizing at the local level the knowledge gained in Sweden. In the substantive sections of the questionnaires, the respondents (both former participants and administration) were asked to indicate what had been the major impact of the training, whether curriculum development, introduction of new or enhancement of existing educational programmes or initiating or strengthening research or applications projects. Participants were also requested to describe in detail both their experience and the main obstacles to either introducing or enhancing remote sensing education in their institutions they had encountered in applying the knowledge gained. Other questions addressed such issues as support received by participants from the administration of their departments or universities, use of teaching materials/imagery/notes they had brought back from Sweden, the number of students who had benefited from the knowledge transmitted to them by former

participants in the course and the use of remote sensing in support of development programmes or projects that were of national importance.

23. Other sections of the questionnaires dealt with general information on former participants and/or their respective institutions, as well as with details of their participation in the United Nations/Sweden training course (year of participation, number of educators from the respondent's institution attending the course, etc.). The questionnaires also had a recommendation section, where former participants and the administrations of their institutions were requested to provide suggestions on further enhancement of the United Nations/Sweden training course, as well as to describe needs for supplementary training and other kinds of assistance required for the successful application of the knowledge received in the course to either introducing or enhancing remote sensing education at the local level.

24. The results of the evaluation survey showed that the training has been a very successful exercise, which, over a 10-year period of time, had allowed educators from developing countries to introduce remote sensing as a tool in the curricula of fields such as agriculture, forestry and civil engineering. This had given the course a high profile and excellent reputation among academic institutions in developing countries. Taking into account the main objective of the course, the series had succeeded in its efforts to train a large group of well-motivated and active professionals capable of developing sustainable educational programmes in remote sensing and GIS at the local level and of using remote sensing in projects that supported development programmes in their respective countries.

25. The survey showed that former participants had been active in applying the knowledge gained in Sweden to enhance existing or introduce new educational programmes in remote sensing and GIS in their respective institutions, as well as in developing curricula or using the knowledge acquired in research or applications projects.

26. The survey also showed that the major obstacle to the ability of former participants to apply the training received in Sweden was lack of funding for the acquisition of the satellite images and data, computer hardware and software, training and reference materials necessary for successful and effective teaching of such an advanced discipline as remote sensing.

27. In addition, the survey clearly demonstrated a strong need for supplementary training in advanced disciplines (digital data processing, GIS, GPS and use of high-resolution data), as well as for periodic training for former participants in order to help them keep abreast of the latest technological developments. Support in organizing joint projects and in establishing academic links and staff exchange programmes was also required.

V. Follow-up action

28. Taking into account the objectives of the course and the results of the survey, the Office for Outer Space Affairs has proposed a number of activities that could be taken in order to increase the success of the programme in the future and to enhance the local impact of the United Nations/Sweden training courses.

29. The proposed follow-up activities include, among other things, the continuation of the practice of selecting qualified former participants in the course for participation in the United Nations/ESA long-term fellowship programme, as well as providing former participants with more short-term training opportunities through the activities organized by the United Nations Programme on Space Applications. It has also been proposed that direct connections between the regional centres for space science and technology education and participants should be established in order to provide the latter with both additional training opportunities and assistance in curriculum development.

30. Detailed information on the results of the evaluation survey as well as proposed follow-up actions will appear in the report on the survey on the local impact of the series of United Nations/Sweden international training courses on remote sensing education for educators (1990-2000) (ST/SPACE/9).